

Action Research:

Improving Student Achievement Through A Restoration Project

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Abstract

This action research project was conducted with a group of forty-two fifth grade students in a suburban public elementary school in northern Baltimore County, Maryland. The research question was: Can an Earth Partnership for Schools (EPS) restoration project be used to teach specific Maryland State Curriculum objectives that the students have not mastered during the course of instruction with the regular curriculum? Data was collected and triangulated via a pre-test and post-test, student interviews, and a collection of work samples. The students completed a series of lessons and activities culminating in restoring a field with twenty native trees and shrubs. The lessons addressed math, science, reading, social studies, and language arts objectives and were completed during reading class. The data shows that there was a positive relationship between student achievement and participation in this restoration project. There was an improvement of eighteen percentage points from the pre-test to the post-test. The student interviews reflected the students having a positive learning experience and the work samples showed improved written language skills.

Introduction

Rachel Carson wrote, “A child’s world is fresh and new and beautiful, full of wonder and excitement. It is our misfortune that for most of us that clear-eyed vision, that true instinct for what was beautiful and awe-inspiring, is dimmed and even lost before we reach adulthood” (Carson, 1956).

This quotation inspires teachers who want to get their students outside to learn. Capitalizing on a child’s sense of wonder can be the key to creating meaningful learning experiences. Unfortunately, raising test scores is the driving force behind the curriculum agenda across the United States. Under the current No Child Left Behind (NCLB) Act, which is a revision of the 1965 Elementary and Secondary School Education Act (ESEA), schools must show adequate yearly progress (AYP). If they don’t, there are negative consequences and ramifications. Test scores determine AYP; therefore, improving test scores has become the focus of most academic programs. While sound pedagogy plays a role determining curriculum practices, at times it seems incidental to the goal of improving test scores. In fact, many schools struggling with test scores have opted to eliminate other subjects and focus on student improvement in the tested areas - reading, math, and science.

The beauty of a restoration project is that ideally, these core subjects are integrated and students can improve mastery of core subject skills, while learning from a meaningful hands-on project. The goal of this action research project was to examine the mastery of specific skills as well as other learning that took place during a habitat restoration project. Ideally, meaningful and purposeful environmental activities can be implemented if it can be demonstrated that they positively impact student learning and test scores.

Literature Review

In 1998 the Pew Charitable Trust supported the State Education and Environment Roundtable that brought together representatives from twelve states to discuss effective environmental education policy. This group commissioned a study to report on the relationship between student achievement and a pedagogical model that used the Environment as the Integrating Context (EIC) for learning. This research found a significant positive relationship between EIC and student learning (Lieberman & Hoody, 1998). Additional research links improved standardized test scores to students exposed to environmental education programs. In 2009, an article published by Bartosh, Tudor, Ferguson and Taylor compared standardized test scores between middle school students who attended schools with a “systematic environmental education program” and those who did not. The quantitative analysis showed that students in schools with systematic environmental education programs performed better on standardized tests. The results of this study were consistent with the findings of a similar study the same authors conducted in 2006.

In 2005 the Maryland Association of Environmental and Outdoor Educators (MAEOE) commissioned a study to examine the relationship between standardized test scores and schools that were designated Maryland Green Schools by MAEOE. To be designated a Green School, applicants must demonstrate that they integrate environmental education studies in the classroom and incorporate best management practices. In her study, Clavijo (2005) used both qualitative and quantitative data. The qualitative data supported the statistical findings in the quantitative data. The results found that when socio-economic and demographic factors were controlled, students enrolled in a Maryland Green School had slightly higher, but statistically significant, scores on the state standardized test. Unfortunately, the state standardized test used as measure

for this study, the Maryland State Performance Assessment Program (MSPAP), was different than the current standardized test, which is the Maryland State Assessment (MSA). Efforts were made to update the 2005 study, but according to Jeanne Armacost, former Maryland Green School coordinator, these efforts were not published or circulated due to questions about their validity and whether the results could or should be corroborated with the earlier study (personal communication, April 8, 2010).

Background

This action research took place in a suburban school in northern Baltimore County, Maryland. The elementary school is one of over 103 elementary schools in the Baltimore County School System, the twenty-sixth largest system in the United States (<http://www.baltimorecountymd.gov/Agencies/economicdev/gateway/education/>). The school building is ten years old and was built on a sixty-four acre site after the ninety-year old school burned down in a nearby location. In the 2009-2010 school year, 555 students were enrolled in kindergarten through fifth grade. Of these students, seven percent received Free and Reduced Meals (FARM) and eighty-nine percent of the student population was white. There were six percent African American, two percent Asian, and three percent Hispanic students that made up the other eleven percent of the student body. The school originally served the children of local farmers, however the population has shifted from rural to suburban as farms have been sold and housing developments built. Although a small group of students receive FARM benefits, the rest of the school population enjoys middle to upper class socio-economic status and many parents are professionals.

MSA test scores are very important in the school and are used by the state and county to gauge school success. Students' scores are categorized as advanced, proficient, and basic. A

school must have a specific percentage of students score advanced or proficient. Basic is considered unacceptable. In 2009, across Baltimore County and the State of Maryland, twenty-two percent of students scored at the basic level in math and fifteen percent at the basic level in reading. Seven percent of our school's students were basic in math and six percent basic in reading. However, the number of children scoring at the basic level at our school has steadily increased since 2006 and there has been an increasing emphasis on test scores (see Appendix A). An additional pressure was added when the 2009 science MSA scores for our school were significantly lower than expected. Twenty-four percent of the fifth grade students scored at the basic level while the county average was thirty-four percent and the state was thirty-five percent (www.marylandreportcard.org). While the school average was better than the state and county, it was much higher than expected from a school that usually performs at a very high level. The amount of pressure and focus on test scores is less than that in many of the other schools in the county. However, the lower science MSA scores and increasing number of students in basic reading and math put a significant amount of pressure on the fifth grade team, and time that had previously been devoted to projects and activities was spent preparing for the test. In fact, I have been teaching at this school for ten years and this is the first year that the fifth grade students were not involved in a stream study and monitoring project. The loss of this activity is a direct result of time being devoted to test preparation.

The school has a long history of conducting environmental education activities. A nature trail and stream access exist on the original and current school site. During the last ten years, the school has earned Maryland Green School status. For the past four years, staffing has been designated to provide pullout environmental education programs to the students. Each class has approximately six forty-five minute sessions per year. During these times the teacher will

reinforce environmental education topics taught during the course of the science curriculum.

This opportunity for the students is not a countywide program, but can be attributed to administrative support and recognition of the impact and importance of environmental education at this particular school. Originally the physical education teacher and I implemented the program. Due to staffing demands and cuts, the physical education teacher is now teaching this alone.

Problem Statement

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There were 101 students in the 2009-2010 fifth grade class. The fifth grade was divided into four reading groups. There were two classes of student identified as “gifted and talented,” one “average” class, and one group of struggling readers. I taught the average group and the struggling group. Within these two reading groups, especially the group with the struggling readers, some of the students did not master key concepts when they were initially taught. The curriculum allows little time for re-teaching. Therefore, the research question for this project was: can an EPS restoration project be used to teach specific Maryland State Curriculum objectives that the students have not mastered during the course of instruction with the regular curriculum?

If the program shows success, then perhaps some of the projects we have abandoned in lieu of test preparation can be revitalized and used to reinforce skill areas where students are struggling.

Methodology

Forty-two students were involved in the researching, planning, and implementation of the restoration project. We planted twenty native trees in a grassy field area that was a forest prior to colonization in Maryland. Before beginning the project with the students, I met with another

fifth grade teacher who teaches math and social studies, because I teach only reading and science. Together we looked at the activities in the EPS manual and other activities that could be conducted. We identified a total of ten Maryland Learning Objectives (MLOs) from the social studies, science, math, and language arts curriculum. They were objectives students might learn throughout the project as well as ones that we felt they had struggled with mastering during the course of the regular curriculum. These MLOs were included on a pre-test (Appendix B) given to students before we started the restoration process. When we finished the project, the students were given the post-test so the scores could be compared. We used the MLOs to guide our instruction because the MSA content comes from this document.

In addition to doing a quantitative analysis and comparison of the pre-test and post-test, qualitative research was conducted by interviewing twenty-two of the students after the project and student work samples were collected (Appendix C and Appendix D). The bulk of the student work samples were from the phenology wheels that the students had worked on once a month throughout the school year. Additional student work samples included their research on their tree or shrub and the descriptive paragraph about it that they wrote as a group. Informal teacher observations were also conducted throughout the project.

For the restoration projects the students were involved in the following activities:

1. Justin Meeker, an educator from the Maryland Historical Society, came to visit each class and gave the students primary source materials to examine. These primary source materials were journals, letters, and paintings from early colonist in the Baltimore County area. From these sources students were able to determine some of the native trees and plants that existed as well as discuss the meaning of native plants.

2. Students were given various native plants and shrubs to research in groups. Their research including identifying the different needs of the plants and well as distinguishing characteristics. They used their research to determine the best placement for the trees in our field that is located on a slope and has different drainage patterns in different areas. Students worked in teams using their individual research to write a brief summary of their assigned plant or shrub. Students also completed a math activity converting their projected tree measurements from feet to meters as we emphasize that scientists use the metric system.
3. The average class went to the field, set up a grid, and drew the land features of their specific area. These grids were combined to create a large map for the class to plan where to locate the different trees and shrubs.
4. The students completed a soil investigation to determine the type of soil in our planting area. To complete this activity they used a key.
5. The students worked in teams with other fifth graders to plant the trees. While planting they had to measure the depth and width of the hole and follow a direction sheet for planting. We recruited parent volunteers to assist with the planting.
6. The students continued to work on their phenology wheels and use various literary techniques to write a poem about their area. During the year the students observed one particular tree or shrub that was already growing on the school grounds. A winter and a spring poem were written about their area.

Results

Pre-test and Post-test

The pre-test was given to thirty-eight students prior to any project activities and the average score was forty-five percent. The student strengths were in the math areas, as most were able to identify coordinate pairs on a graph and most were able to measure to the nearest centimeter. Many of the students were able to correctly identify a food chain, but very few were able to identify the impact of technology on the environment. The weakest areas were the social studies--related objectives and identifying how plants adapt to different environments.

The post-test was given to forty-one students immediately following the planting day. The average score improved to sixty three percent. It is interesting to note that several of the students who got the original coordinate pair question correct in the pre-test, got it wrong in the post-test. While the students were able to identify the numbers correctly, they reversed the x and the y. It is possible that they had just reviewed this concept in math prior to the pre-test and had forgotten it by the post-test. Most of the errors occurred among students in the lower level class who did not participate in creating the grids for planning. Although the intent was to review this skill in the lessons, it did not get reviewed other than for the grid activity.

The greatest improvement was students correctly identifying the impact of technology on the environment. Many of the student responses included mentioning a rain gauge or rain barrel as technology. The rain barrel is a feature we added to the planting area to assist with project maintenance. Informal instruction was very effective in discussing the impact of technology on the environment. I made a conscious effort to discuss this with the small student groups as they planted the trees. One student's response to this question showed that the rain barrel made an impact on his learning. He wrote, "If you take a barrel and fill it with water then cut a hole in it,

the gravity is pulling down and you can water plants.” This response was significant to me because while we were working on the restoration project in reading, I was working on physics and discussing forces in science class. This experience allowed the student to synthesize his learning and represents a prime example of the efficacy of environmental education.

Another frequent response to this question illustrates the integration of our project and current events. Many of the students related the Gulf of Mexico oil spill and need for gas and/or use of drilling as an impact that technology has on the environment. One student who struggles with learning disabilities and frequently has difficulty processing information, wrote, “Cars need oil and when a oil spill, the oil goes in the water and kills sea animals in there if they breath it in.” Clearly, he was able to link technology and the environment to classroom discussions we had about the Gulf Oil Spill. While it was not directly related to this project, the discussions we had about technology and the environment in the course of this project impacted his learning.

Most students were still unable to identify how different plants adapted to different environments, however there was a significant improvement in the quality of the response. In the pre-test many students left the two questions dealing with adaptation blank or the responses showed little understanding of the concept. In the post-test students were unable to identify the specific adaptation made; however they did identify the cause for adaptations that would need to be made. For example, many students wrote that if a sunflower was in a forest habitat it would need to adapt to having less sunlight.

Interviews

The interview questions yielded some expected results and some surprising results. The most surprising result was the high number of students who were unable to tell me what “restoration” means. Although the project was presented to the students and I explained the

meaning of restoration, they were unable to define the meaning of the word in the interview. Another surprise was that many of the students did not recall doing the primary source activity with the representative from the Maryland Historical Society. When I rephrased the question from “what did you learn doing the primary source activity” to “what did you learn when we looked at the journal, letters, and pictures the man brought to our class” more of the students recalled the activity. However, there were nine students who had no recollection of the activity and they attended class that day!

All of the students felt that this activity should be done with classes in the future and other than because it is “fun” they felt it should be done for the following reasons:

- So people can learn more about the environment
- People can learn more about trees in Maryland
- People can learn to plant trees for the future
- It is important to learn about nature so you don’t ruin it

When students were asked what they learned from completing the project, most of them gave facts about the tree or shrub they researched and planted. The favorite activity was mostly planting, although there were several children who commented that they really liked the planning and creating the grid for the planting.

The most encouraging response from the interviews was that every student believed it was a worthwhile project. I made sure to interview a wide range of students who represented all of the demographic groups from the two classes and well as those who I knew really enjoyed the outdoors and those who did not.

Student Work Samples

The student work samples were the most rewarding part of the data collection. The phenology wheels that we created this year showed immense student growth in observational and the writing skills. In the interview when students were asked what they learned from the phenology wheels, they mostly responded that they learned how much an area could change in a short amount of time. However a few students shared observations similar to this student who said, “I learned that peace and quiet can do some good and you can think about something and write about what you think.” None of the students commented on how it helped their writing skills, yet their wheels and poems show growth and mastery of literary techniques including alliteration, onomatopoeia, personification, simile, and metaphor. One example of improvement is from a struggling student who wrote in September:

All of the plants and trees died. There are a pile of rocks. I seen a butterfly. There is plenty of sun so the flowers can grow.

In April she wrote:

The trees, plants and flowers are growing. I can feel the wind blowing in my face. There is no sign of children. When I look beside me, I see wood on the ground. I see no clouds in the sky, but I see jets flying across. I can see the beautiful butterflies flying around. I remember when it was winter and it was colder and it looks a lot different. The pile of rocks are still there. It smells like nature out here. The birds are flying around and peeping.

Other work samples that were collected include the student research on their shrub or tree. This work sample did not yield much insight into the student learning, although the students enjoyed the research and the paragraphs they wrote about their trees will be posted on an

information board next to the plantings. Observing the students doing the research was helpful because it allowed me to become familiar with vocabulary terms that needed explanation or clarification (i.e. deciduous, evergreen, breadth, canopy).

As I observed and worked with students completing the activity converting standard measurements to metric, I was surprised by how many of the students were struggling with rounding numbers and decimals. This skill is taught in the beginning of the school year for both fourth and fifth grades.

Action Plan

While conducting the restoration project, I found that a significant amount of energy was spent on the logistics and practical parts of the implementation (acquiring the trees, making sure they were watered until we were ready to plant, securing the appropriate permission to plant, getting volunteers to help supervise the children planting, etc.) This detracted from the amount of time that was available to focus on the lesson and lesson implementation. Ideally, the project timeline would be extended to allow for more time implementing the lesson. Unfortunately, due to testing demands on our fifth grade students and teachers, this may not be realistic.

The positive impact of the phenology wheels was very inspiring and I plan to continue to implement them with my reading group and share the idea with other staff members. This seemed to have an especially positive impact on the struggling readers and writers. There is a local community group who sent volunteers to help us with the planting and when I shared some of the student poems with them, they asked to publish some of the poems in their newsletter and on their website. The students were very excited and this had a positive impact on their perception of their own abilities and strengths. Next time, I will purposefully seek out publication opportunities for the student poems. This activity was a favorite throughout the

school year and as soon as the first of the month came, students were asking when we were going out to work on our wheels for that month.

I was extremely concerned that so many of the student interviews showed a lack of understanding of the term “restoration.” I used this term exclusively with the students when referring to the project and they knew I was talking about our “tree planting” but did not completely grasp the concept. I would plan an introductory lesson to the project and include some time to allow the students to discuss what they think the word means, look it up, then use the term in an application of their own. This aspect of the interviews was especially disconcerting with the lower group because in addition to the restoration project planting trees, we grew submerged aquatic vegetation and went on a field trip to plant it in the Chesapeake Bay as a part of an underwater grasses restoration project, partnering with the Maryland Department of Natural Resources.

An additional concern was that so many of the students did not recall the presentation from the Maryland Historical Society. This was disturbing because it is an important piece of the research and because we paid for him to come present to the class. Due to time constraints, the presentation was limited to one hour and there was not much time for follow up activities. Therefore, in the future I would schedule one or two days of class time to follow up on his presentation and give the students more time to work with the primary source documents. I think it would be very effective to link this to the lesson discussing the meaning of restoration. Additionally, I would have the students create their own primary source document to connect the concepts. Students could write their own journal entry or write a letter describing our project. This would allow me to assess their understanding of restoration, while reinforcing the concept of a primary source document.

Final Reflection

While the results of this research are positive in showing a correlation between the restoration project and student performance on formal and informal assessments, I feel the biggest weakness was the amount of time devoted to in-depth coverage of the various topics. The competing demands for time and trying to get in this non-required “extra” project was extremely frustrating. While it was worth it in the end, I did not feel success as much as relief when we finished.

The process of the action research project was very beneficial because I had the opportunity to reflect on the various aspects of instruction throughout the project. Student input was very valuable and the students felt even more a part of the project when they were asked for their input and reflection. Some of the students struggled with classroom behavior and to stay on task during regular instruction. These challenges did not exist while we did this project. Another interesting action research would be to investigate student attitudes and behaviors while conducting a hands-on project such as this. I believe that one of the factors that increases student learning in such hands-on projects is that students who struggle to maintain focus during regular instruction are engaged and their learning is maximized.

Note to not be “officially” included in the paper: As I was writing this project, the 2010 MSA scores for reading and science arrived at our school. Officially the scores are “embargoed” and not permitted to be released, published, or shared with the public until the state allows. However, my principal said I could share with you all that in 2009 five of the struggling students scored basic in reading, but in 2010 only two students scored in this category and those two students faced the greatest learning disabilities. All three of the second language learner students scored

in the proficient category. This is significant because two of the three second language students were have only been in the country since third grade and are still learning English. The excitement for me comes with knowing that the students in that reading group completed two restoration projects. Although I cannot make any direct connection, I believe that the year-long use of phenology wheels and the restoration projects played a role in this improvement.

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